

in music and one on ARPEGGIO, by Mr. Franklin Taylor; an interesting account of the ACADEMIE DE MUSIQUE, by Mr. John Hullah; an excellent little treatise on ACCENT in music, with abundant musical examples, by Mr. Ebenezer Prout; another on ACCENTS in plain song, by the Rev. Thomas Helmore; instructions as to ACCOMPANIMENT, by Mr. Hopkins, of the Temple, supplemented by another article on ADDITIONAL ACCOMPANIMENTS, by Mr. Prout; AEOLIAN HARP is from the pen of Mr. Hipkins; ANTHEM is given by Dr. Monk, of York; ARRANGEMENT, by Mr. Hubert Parry; BAGPIPE, by the writer of this notice. In the biographical department, which is especially full, a long and exhaustive account of the BACH family, by Herr Maczewski of Kaiserslautern, stands foremost. There are also interesting notices of ADOLPHE ADAM and of AUBER, by Mr. Franz Hueffer; of many Italian composers, by Mr. Edward H. Pember, Q.C., of DR. ARNE, and of ATTWOOD, by Mr. Husk, Librarian of the Sacred Harmonic Society; of DR. ARNOLD, and a sympathetic biography of MICHAEL BALFE, by the late Dr. Rimbaud. Sir Frederic Ouseley and the Editor contribute several smaller notices. The names of English musicians appear to have received especial attention.

There can be no hesitation in saying that the work just commenced promises to fill a gap in English bibliography, and that it furnishes excellent material for reference. Besides this, it presents the collateral advantage of offering a charming combination of amusement and instruction for desultory reading in the many *horæ subsecivæ* which occur even in the lives of the most busy.

W. H. STONE

#### OUR BOOK SHELF

*Pioneering in South Brazil. Three Years of Forest and Prairie Life in the Province of Paraná.* By Thomas P. Biggs-Wither. Two vols. With Map and Illustrations. (London: John Murray, 1878.)

MR. BIGGS-WITHER has written two volumes of genuine and varied interest and much instruction, as a result of his three years' work in a little-known region of South Brazil. He went out as one of an engineering party to open up a road between the Atlantic and Pacific, and he traversed much of the country on the banks of the rivers Ivahy and Tibagy, tributaries of the Paraná. Much of his time was spent in the forests of this region, virtually unexplored, and presenting a splendid field for any enterprising naturalist. Mr. Wither is an excellent observer, and his book abounds with information on the natives, the natural history, and physical geography of the region. He met with many adventures, and suffered much from heat and insects, but altogether he seems to have had a thoroughly enjoyable time of it. He writes throughout in an attractive and simple style, and his work must be regarded as an important contribution to a knowledge of the luxuriant region with which it deals.

#### LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.]

#### The Phonograph

We shall be much obliged if you will allow us to draw the attention of your readers to a curious fact which the phonograph

has allowed us to prove, and which we announced last Monday at a meeting of the Royal Society of Edinburgh. We have seen no mention of the fact elsewhere.

Not only are vowels unaltered by being spoken backwards, but the same fact is true of consonants. Whether the pulsations of air be made in a given order or in the reverse order the ear accepts the sound as indicating the same letter. This is true of all the simple vowel sounds and of all the simple consonant sounds, including of course several combinations which in English are spelt with two letters, as *th* or *ng*, but which are really simple consonants.

We tried the experiment on single pairs of syllables separated by a single consonant, as *ada*, *aba*, *aja*, etc. A person coming from outside and ignorant of what consonant had been spoken was able to identify the consonants quite as well backwards as forwards. The chief difficulty was found in distinguishing *affa* from *assa*.

We find that this peculiarity is not limited to consonants between vowels, but that *ab* said backwards becomes *ba*. We have here a standard as to what does really constitute a single letter or element of articulate speech; it is any one reversible part. Your readers who possess a phonograph may most easily verify this observation by saying a word backwards, and hearing the phonograph say it intelligibly for words; for instance, *noshæessosa* produces association beautifully.

We shall be glad to learn whether this fact has been already published, and also whether it was foreseen as a possibility by any writer.

FLEMMING JENKIN  
J. A. EWING

Edinburgh, March 25

#### The Age of the Sun's Heat in Relation to Geological Evidence

I. It is an admitted fact that the age of the sun's heat will not harmonise with the evidence of geology, on the supposition that this heat was *solely* derived from the approach of matter under the action of gravity. Dr. James Croll, in dealing with this question in a recent number of NATURE,<sup>1</sup> has suggested the existence of a previous proper motion in the colliding matter that formed the sun, whereby, in accordance with accepted physical principles, a store of heat adequate for any period might have been provided. However a difficulty is raised here by Dr. Croll, in the *Philosophical Magazine* (May, 1868), where this question is first dealt with, and as this difficulty would seem on examination not to be insurmountable, I venture to call attention to the subject here, more especially as attendant questions of interest would seem to attach to it.

2. Of course it is admitted that the age of the sun's heat is the limit to conditions of life on the earth, and the point in question is that if the sun had acquired such a store of heat as geological time would appear to demand, then the sun must have been (owing to the excessive heat) a very extensive nebula, probably extending far beyond the limits of the present solar system, and consequently, that even if such a store of heat had existed in the sun, it would not be available for geological time, since the earth could not then have existed as a separate planet, from the fact that the solar nebula would then have extended beyond the limits of the earth's present orbit. Dr. Croll says (p. 372): "But if the sun had originally possessed the amount of energy supposed, then its volume would have extended beyond our earth's orbit, and of course our earth could not at that time have existed as a separate planet." This, therefore, puts a difficulty in the way of the sun having possessed such a store of heat as would be available for geological time. The accepted principles of Laplace are, of course, admitted here, according to which the earth originally formed part of the nebulous mass of the sun, and became naturally detached through the rotation of the nebula at its contraction.

3. Here it seems to have been tacitly assumed (according to the quotations above given) that the present orbit of the earth was its *original* orbit. Is there, however, any necessity for assuming this? For in this lies all the difficulty. Are we not rather warranted in inferring from accepted principles that the present orbit of the earth was *not* its original orbit. For it is an admitted fact that resisting media (the ether, &c.) exist in space, by which, through friction, the orbits of the planets are gradually becoming contracted, so that they slowly approach the sun. It is a mere question of time, therefore, for the earth to have come in towards the sun from any distance, or its original

<sup>1</sup> NATURE, vol. xvii. p. 206; also Quarterly Journal of Science, July, 1877

orbit might (for anything we can say to the contrary) have been beyond the present orbit of Jupiter. However slowly we may suppose the earth to be approaching the sun, yet in the vast epoch of time (which is precisely what is necessary in order to harmonise with geological evidence) it may have approached millions of miles towards the sun. There is one point of peculiar harmony here which is worth noticing in connection with this, viz., as the sun cools down or gives out less heat to the planets, so the planets reduce their distance from the sun; thus tending to equalise the heat conditions suitable for life. Thus, although the heat of the sun when first formed may have been enormously greater than it is at present, yet on account of the distance of the planets (including the earth) from it at that remote time, the conditions for life may have been as favourable as now, and thus the first geological changes may have commenced on the earth at that remote epoch when the sun was an incandescent nebula occupying a vastly greater volume than now (perhaps even the volume of the earth's present orbit), or, under these conditions any interval of time for life on the earth that geological evidence may require is afforded.

4. There is another point that would appear to be of interest in connection with this subject. The rate at which a planet approaches the sun through friction in the media in space would depend (admittedly) on its mass, or would be greater when its mass is less. It follows evidently from this therefore that the great planets, Jupiter, Saturn, &c., must have approached the sun at a slower rate than the earth (or the smaller planets generally). It would follow therefore (more particularly in view of the vast epoch of time demanded by geology) that the relative position of the planets must have changed from this cause, that the earth, for example, must at one time have been nearer Jupiter than at present; more especially as the greater velocity of the earth in its present contracted orbit causes greater friction (and thereby brings the earth more rapidly towards the sun). Indeed it is an evident consequence of this principle that it would require only a certain relative difference in mass of the planets (or in the length of the elapsed time) to have made the small planets occupy positions beyond the larger planets originally, and so the positions of the planets to have been reversed, i.e., the smaller planets furthest from the sun, and the larger planets nearest. The tendency of the friction evidently is to arrange the positions of the planets, so that the larger are furthest from the sun.<sup>1</sup> This it may be noted is the position at the present time. We do not of course mean to assume necessarily that there has been an actual reversal in the positions of the planets; all we adduce is that friction must inevitably tend to change relative position, when the masses of the bodies are different, and whether the positions are reversed depends therefore on the time during which this cause was in operation (and here we are considering especially the vast interval of time required by geology)—the change of relative position being more rapid the greater the relative differences of the masses. Thus it is a known fact that a meteorite approaches the sun or contracts its orbit at an enormously more rapid rate than a planet. It is so far certain that through friction in the medium known to exist in space, the planets (whose masses are different) must have changed to some degree their relative positions, or that the earth (for example) must have been nearer Jupiter at one time than it is now. These it should be observed cannot be regarded as speculations, but rather as deductions dependent on accepted principles.

5. Time may evidently have as great significance in physical as in geological changes, or in giving time its full import great results may follow; and it will be admitted that it is of interest to trace the slow operation of causes into their legitimate results through lengthened time epochs, not confining the attention to the infinitesimally narrow range of human experience.

London, March 21

S. TOLVER PRESTON

#### English Lake-dwellings and Pile-structures

GENERAL LANE FOX has described the old, and, in some cases, successive pile-works in the peat of Finsbury and Southwark, outside Roman London (*Anthropological Review*, vol. iv. No. 17, April, 1867, pp. lxxi. et seq.). Another very interesting case was evidently under Sir C. Bunbury's observation in 1856,

\* It would seem a rather curious fact to note that those planets which contain within themselves the greatest store of heat (i.e., the large planets), and which therefore would probably be the longest time before they were adapted to the conditions of life, are those which approach the sun the slowest. It is also evident that the fact of the earth being a small planet would tend to augment the difference between the range of its present, and that of its original, orbit.

near Wretham Hall, six miles north of Thetford, where, in a drained mere, "numerous posts of oak-wood, shaped and pointed by human art, were found standing erect, entirely buried in the peat." Red-deer antlers, both shed and broken from the skull, and also *sawn* off, were found in this peat. (See *Quart. Journ. Geol. Soc.*, vol. xii., p. 356.)

Since writing the above, I have been informed that Mr. W. M. Wyllie, F.S.A., referred to this fact in "Archæologia," vol. xxxviii., in a note to his excellent memoir on lake-dwellings. I can add, however, that remains of *Cervus elaphus* (red deer), *C. dama*? (fallow deer), *Ovis* (sheep), *Bos longifrons* (small ox), *Sus scrofa* (hog), and *Canis* (dog), were found here, according to information given me by the late C. B. Rose, F.G.S., of Swaffham; who also stated, in a letter dated August 11, 1856, that in adjoining meres or sites of ancient meres, as at Saham, Towey, Carbrook, Old Buckenham, and Hargham, cervine remains have been met with: thus at Saham and Towey, *Cervus elaphus* (red deer); at Buckenham, *Bos* (ox) and *Cervus capreolus* (roe-deer); at Hargham, *Cervus tarandus* (reindeer).

The occurrence of flint implements and flakes in great numbers in the site of a drained lake between Sandhurst and Frimley, described by Capt. C. Cooper King, in the *Journal of the Anthropological Institute*, January, 1873, p. 365, &c., points also in all probability to some kind of lake-dwelling, though timbers were not discovered.

Lastly, the late Dr. S. Palmer, F.S.A., of Newbury, reported to the "Wiltshire Archæological Society" in 1869, that oaken piles and planks had been dug out of boggy ground on Cold Ash Common, near Faircross Pond, not far from Hermitage, Berks.

T. RUPERT JONES

#### Selective Discrimination of Insects

As bearing on the question discussed by "S. B." and by Mr. Bridgman and others, at p. 163 *ante*, and in previous numbers of NATURE, the following observations may have some interest. One day in the latter part of July, 1877, I took on a flower of red clover (*T. pratense*) an humble-bee (*Bombus Carolina*?), having the hairs of its body and legs densely dusted with pollen-grains of an *Althea*, which was in full blossom in the same enclosure, about one hundred feet from the spot where I took the bee.

On the same day and at the same place I attempted to take another *Bombus*, which was ravishing a flower of the same species of clover. It escaped me, and, flying to a distance of about twenty feet, alighted on a flower of a Canada thistle (*Cirsium arvense*), into which it immediately plunged its tongue. After watching it feed for a moment or two, I again attempted to capture it, when it again escaped, and, flying to about the same distance as before, alighted on a flower of a larkspur (*Delphinium Consolida*), and upon my third attempt to take it, it flew away and disappeared.

As whether insects are attracted by odour or colour, I wish to call attention to an observation of Mr. Crouch, as detailed by Mr. Gosse in "A Year at the Shore." "*Tealia crassicornis* is as good a mimicry of the great dahlias as the *Sagartia* are of the daisies." "Even bees are occasionally deceived. Mr. Crouch, when once looking at a fine specimen which was expanded so close to the surface that only a thin film of water covered the disc and tentacles, saw a roving bee alight on the tempting surface, evidently mistaking the anemone for a veritable blossom."

Covington, Ky., U.S.A.

V. T. C.

#### The Telephone as a Means of Measuring the Speed of High Breaks

IN some experiments with an induction coil and wheel break which I have lately been engaged on I have found the telephone useful in determining the number of times per second in which the current is broken.

For this purpose it may be attached to the secondary terminals, or the whole or part of the primary current may be passed through it.

The telephone may also be used generally for determining the speed of electro-magnetic motors by taking advantage of the fact that the current driving them is either short-circuited or broken a definite number of times in each revolution. The telephone wires may in this case be attached at two points some distance apart on one of the battery wires. The note of the telephone gives the number of breaks per second.

Pixholme, Dorking, March 17

J. E. H. GORDON.